A Scientific Assessment of Nutrient Concentrations, Loads, and Biological Responses in the Northern Gulf of Mexico: Strategy

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Problem Identification

- States are required to develop nutrient criteria to protect estuarine and coastal ecosystems from eutrophication
  - Section 304(a) of the Clean Water Act (CWA) directs EPA to develop and publish criteria guidance to assist states and authorized tribes in developing water quality standards that are protective of designated uses
    - nutrient criteria recommendations are intended to protect the integrity of coastal ecosystems from the adverse effects of cultural eutrophication

Problem Identification

- Estuaries and nearshore coastal waters naturally vary in the type, abundance, and geographic coverage of biological communities at risk to nutrient over enrichment
- **Thus**, a single national criterion or a regional criterion applicable to all estuaries is not possible due to largely unique systems
- **Therefore**, the nutrient criteria guidance (Nutrient Criteria Technical Guidance Manual-Estuarine and Coastal Marine Waters. EPA-822-B-01-003) suggests that a **reference approach** be used for nutrient criteria development

Problem Identification

- Reference conditions are defined as the best existing estuarine or marine water within a watershed or coastal area
  - Reference conditions implicitly incorporate the relationship between living resources and nutrient loads where human influence is at a minimum
  - An "implied" reference condition developed by comparing the "*best of what's left*" with "*what used to be*" established by the historical record may be required
- Approaches to assess reference conditions and develop criteria include the use of
  - current and historical data,
  - dose response relationships, and
  - models

Problem Identification

- Gulf states are moving toward nutrient criteria and need data that will help them set criteria for the variety of coastal and estuarine waters
  - Criteria cannot be set until information is available for the states to use in the development of nutrient criteria and management responses
- How do we develop that information set??
- What's the best approach for developing the reference condition?

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Steps towards developing the information

- The Gulf of Mexico Program Office, at the request of EPA Headquarters and EPA Region 4, agreed to facilitate and coordinate a data assessment process for a meaningful characterization and ecosystem assessment of nutrient load/responses for the near coastal waters and associated estuaries of the northern Gulf of Mexico

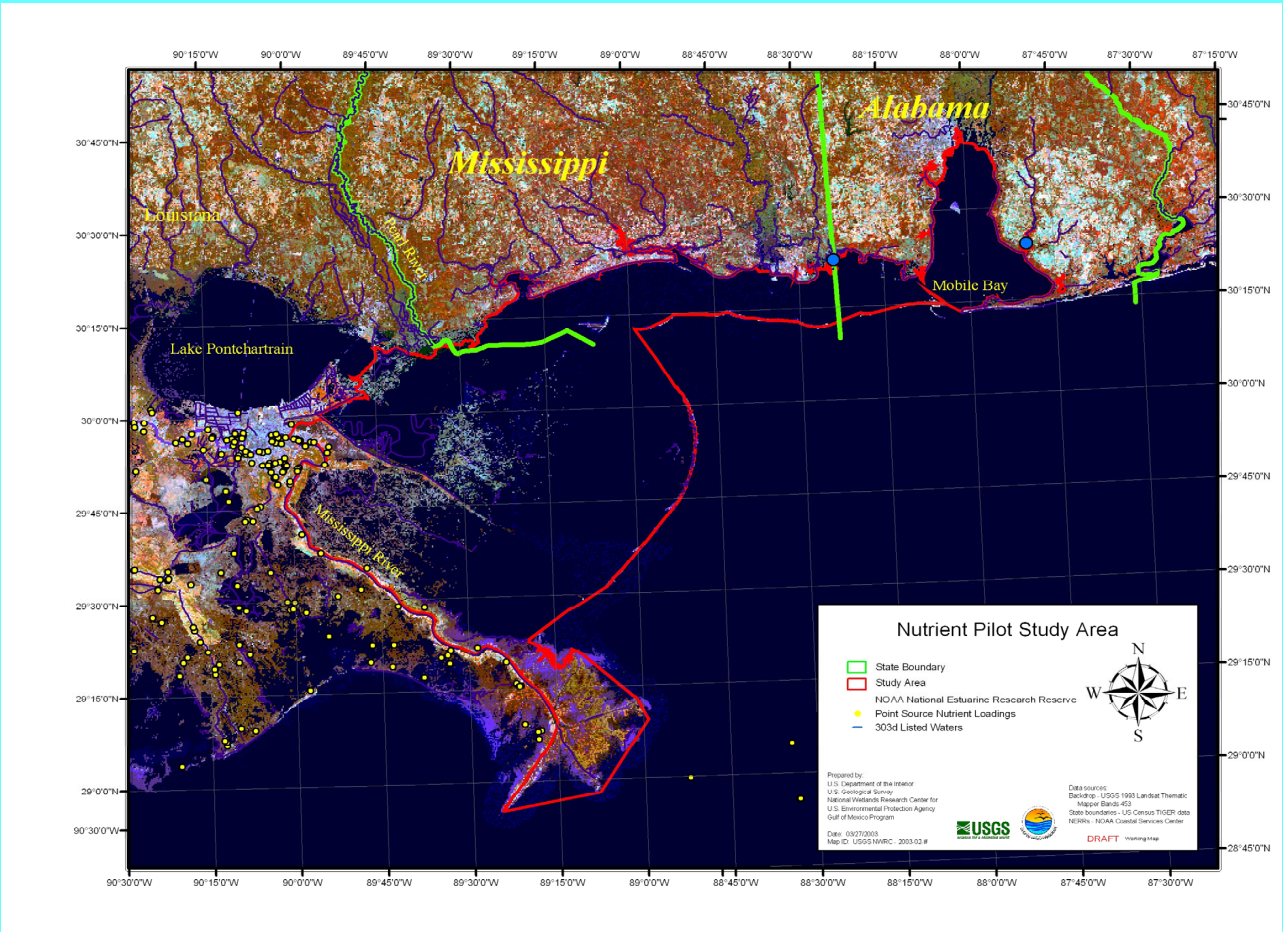
Steps taken

- Initial scoping meeting
  - are the states interested? **YES**
  - is there enough information to go forward? **NO**

- Kick-off meeting conducted in February 2003
  - **Defined problem:** Need for estuarine and coastal assessment to support nutrient criteria development
  - **Agreed to the study area:** Extends from the Mississippi River-Gulf outlet through Mobile Bay and contains water bodies within the jurisdiction of the states of Louisiana, Mississippi and Alabama
  - **Developed assessment strategy/approach:**

Study Area

- Study area: Lake Borgne, Chandeleur and Breton Sounds, Mississippi Sound, Mobile Bay, and the associated estuaries and near coastal waters



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Assessment Purpose and Scope

- Provide information that can be used by states in the development of nutrient criteria and management responses
- Develop a scientifically based characterization and assessment/analysis of the northern Gulf of Mexico ecosystems as they relate to nutrient concentrations and loadings
- Consider potential reference approach

Activities Completed and Importance of the Effort

- Steering committee established
- Viable collaborative partnership with the three states, local universities, EPA Regional offices, and other Federal agencies established
- Identified potential for significant benefit to the Gulf states
- Importance of the study findings
  - Transferable to other estuarine/coastal water environments, within EPA Regions 4, 6, and others
  - Will provide vital information to supplement EPA's existing guidance
  - Needed to provide support and assistance to those states using scientifically based alternative approaches to develop nutrient criteria

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Key causal and response indicators identified selected to date

- Causal indicators
  - total phosphorus (TP)
  - total nitrogen (TN)
- Response variables
  - algal biomass (chl *a*)
  - a measure of water clarity (Secchi depth)
  - dissolved oxygen (DO)
  - other parameters necessary

The challenge

- Obtain data
- Look for relationships among and between
  - nutrient data (TN, TP, algal biomass, water clarity, and DO)
    - Others Si, nutrient ratios, etc.?
  - physical factors, hydrography, water exchange, stratification
  - primary production, collectively and individually
- And to
  - higher trophic levels,
  - changes in species composition,
  - changes in biomass of benthic macroinfauna, and
  - changes in fisheries
- Stressors other than nutrients may affect the distribution and abundance of living resources
  - How to best include these?

Approach: Phased and implemented within available resources

- Phase 1: Establish a system to determine and access the best available data for the project
  - Develop a Combined Work/Quality Assurance Project Plan (CW/QAPP) that describes the mechanism for acquiring and applying the data (e.g., appropriateness of sampling and analytical techniques, data management, and adequate sample location descriptions)
  - Identify nutrient data sources for the study area (in process)
  - Prepare a data compendium (In process)
  - Analyze current and historical nutrient data
- Phase 2: Data analysis and reporting
  - Assess the data spatially (location/coverage) and temporally (month, season, year, or continuous)

Nutrient data sources and data

- Historical information is important to establish a perspective on the condition of the study area.
  - Data collection and assessment process for key indicators initiated by screening the existing U.S. EPA Legacy **Sto**rage and **Ret**rieval (STORET) and Ocean Data Evaluation System (ODES) databases
- State and other federal agency records are the basis for continuing data search
- GMP has made substantive progress on data set identification
- **What are the next steps?**

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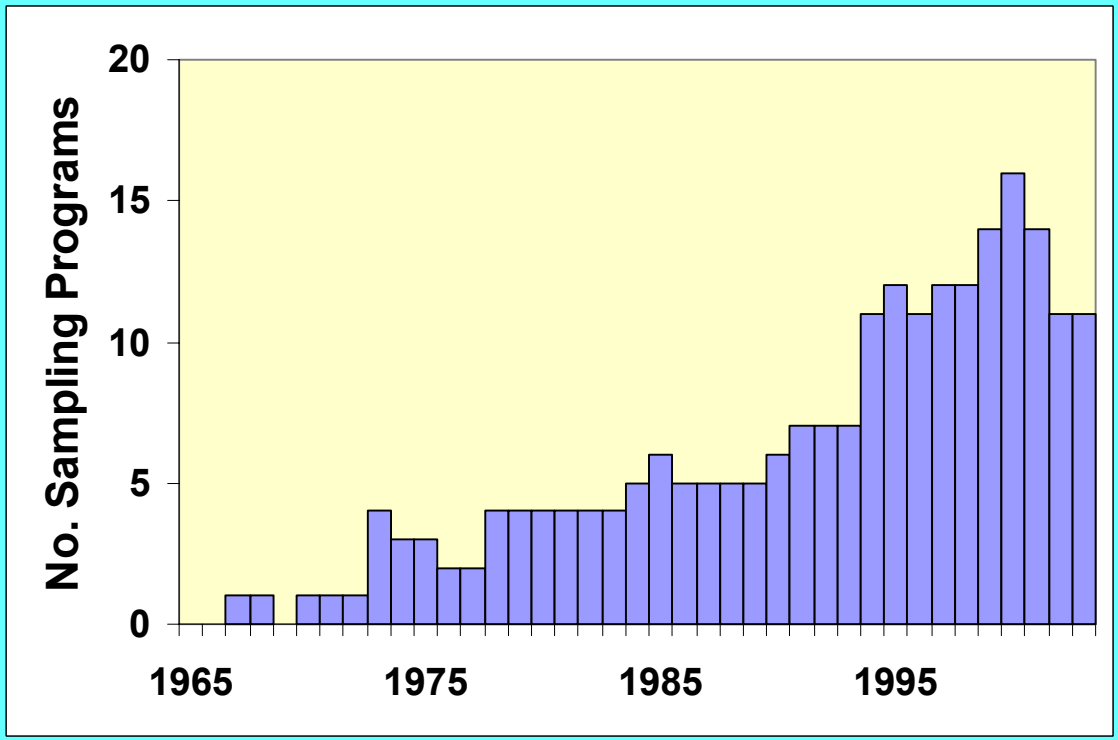
Reaching out for data

- GMP has initiated the identification and collection of data within the study area
  - Approximately 35 studies from 1967 to present
  - Data from at least 800 sites potentially available



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Reaching out for data

- Additional sources to be identified and data requested by GMP
  - Universities
  - Additional federal and state agencies
  - Citizen monitoring programs/local watershed councils
  - Private
  - Anecdotal
- Importance of conveying the purpose/need for obtainig data to potential data sources
  - Non-threatening nature (credit paranoia)
  - Contribution to larger, regional database – no liabilities
  - For public benefit

Data selection and QA/QC process

- Data to be selected and characterized based on:
  - Basic quality
  - Completeness
  - Comparability
  - Representativeness
  - Ability to contribute directly to Nutrient Condition Assessment
  - Geographical and temporal distribution
- Strive to assess reference sites and/or conditions
  - Comparable reference sites exhibiting favorable conditions
  - Historical reconstruction of favorable conditions

PHASE I – Tasks and deliverables

1. Prepare Scope of Work (GMP) - DONE
2. Develop Combined Work/QAPP - DONE
3. Select attributes that characterize the nutrient condition and describe rationale for selection and describe rationale for omitting other attributes
4. Identify agencies, and Non-Government Organizations (NGOs) with pertinent data and existing datasets

PHASE I – Tasks and deliverables

5. Compile datasets into uniform, relational electronic database
6. Prepare interim report (content):
   - Summarize progress
   - Provide specific information about each data set
     - Collection method
     - Data gaps
     - GIS layers representing temporal and spatial data density
     - Recommended procedures for data analysis (Phase II)
7. Report reviewed and approved by the Steering Committee

PHASE II – Tasks and deliverables

1. Analyze data for spatial patterns and temporal trends;
2. Analyze correlations among cause and response relationships;
3. Determine if acceptable reference conditions exist based on current or historical information;
4. Develop a suite of generic conceptual models for the study area;
5. Conduct in-process progress review by Steering Committee;
6. Prepare draft final report for review by the Steering Committee;
7. Prepare final report for peer review

Schedule

Phase I	
1. Scope of Work/Award	March 2003
2. CW/QAPP	June 2003
3. Database completion	December 2003
4. Interim report	February 2004
Phase II	
1. Preliminary results	July 2004
2. In-process review	February 2005
3. Draft final report	September 2005
4. Final report	December 2005

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Collaborators

Louisiana Department of Environmental Quality
Louisiana Department of Natural Resources
Louisiana Department of Wildlife and Fisheries
Mississippi Cooperative Extension Service
Mississippi Department of Environmental Quality
Mississippi Department of Marine Resources
Mississippi Department of Agriculture and Commerce
Alabama Department of Environmental Management
Alabama Department of Conservation and Natural Resources
Dauphin Island Sea Lab
Gulf Coast Research Laboratory
USEPA Headquarters
USEPA/ORD Gulf Breeze
EPA Regions 4 and 6
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